SYSTEM AND METHOD FOR MANAGING RETURNABLE CONTAINERS

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FIELD OF THE INVENTION

[0001]   The present invention relates generally to systems and methods for managing returnable containers. Specifically, it relates to a computerized system and method for categorizing returnable containers and managing an inventory of returnable containers according to the categories so that an adequate number of containers is allocated to each supplier in a manufacturer's parts supply chain.

BACKGROUND OF THE INVENTION

[0002]   Many manufacturers use returnable or reusable containers to facilitate the flow of parts for the manufacturing process. The containers are used to transport parts from suppliers' facilities to the manufacturer's facility. Once the full containers that have been received from the suppliers are unloaded, they are typically transported to a returnable container center (RCC) at or near the manufacturer's facility where they are prepared for shipment back to the suppliers. The suppliers then reload the containers with parts and the full containers are transported to the manufacturer's facility.

[0003]   Different types of containers are allocated to suppliers based on the type of parts that each supplier produces and delivers to the manufacturer. Some supplier's may require "specials" (e.g., specially adapted containers) while others may use "generics" (e.g., modular totes, pallets, or racks). Most of the containers may be used

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interchangeably by many of the manufacturer's suppliers. It is not necessary for each supplier to have a dedicated set of containers of a particular type. As along as the supplier receives containers of a suitable type for transporting the parts to the manufacturer's facility, any set of containers of that type may be shipped to the supplier for packaging the parts.

[0004]   Allocation of containers to suppliers is often accomplished as follows. A manufacturer may operate a RCC at the manufacturer's facility where the containers (e.g., modular totes, pallets, racks, etc.) are pooled. A monthly forecast is used to generate a daily average for allocation of containers to each supplier. Each supplier's allocated quantity is based on full production days for the month (daily average allocation x number of full days). This quantity represents the supplier's proposed inventory of containers. Part receipts at the manufacturing facility (e.g., based on review of part supply orders) are used to reduce each supplier's inventory. Shipped quantities (based on the supplier's allocated quantity) are immediately moved into the supplier's inventory after RCC loads the truck with the supplier's allocation of containers. As a result, the container inventory is only visible in relation to the supplier and is only an estimated quantity at the RCC.

[0005]   For a manufacturer with multiple facilities, each RCC facility may be using a different calculation to allocate container shipments to suppliers. For example, one facility may use estimated quantities based on the daily average allocation and number of full days as explained above and a spreadsheet program to track estimated and actual quantities. Other facilities may use a special computer program. In some instances, however, no computerized tracking may occur so the manufacturer's

associates simply guess what each supplier's requirements will be. The guess may not be as accurate as the estimated quantity based on the daily average allocation and number of full days. Finally, a manufacturer's facility may choose to return to a supplier every container that it receives from the supplier on the assumption that the supplier will require the same number of containers that it used for the previous shipment.

[0006] None of the methods that are currently used support automated and accurate allocation and tracking of containers. More importantly, they do not result in allocation of containers according to the supplier's needs as they relate to the manufacturer's actual production needs. The calculation method of allocation based on averages instead of actual production needs results in an over allocation of containers to suppliers who may not need them and an insufficient allocation of containers to suppliers who may need them. The monthly averages do not account for fluctuations in daily demand for parts that may occur in the actual production schedule.

[0007] Furthermore, there is no accountability for shipped or mis-shipped quantities from the manufacturer's RCC. There is no visibility of inventory movements or verifications to or from the supplier, internal to the manufacturer, or in-transit. Finally, there is no visibility to the entire system inventory across manufacturing. Although attempts may be made to rely on data in part supply orders, the order data does not always reflect the actual container types shipped causing further errors. In addition, there is no supplier visibility to allocated quantities. Inaccurate allocation quantities are sent to suppliers causing inventory buildup at the suppliers' or the manufacturer's facilities.

[0008] Failure to allocate and track and therefore, maintain an adequate inventory of containers may be costly to the manufacturer, especially when the manufacturer owns the containers and must account for costs associated with use of the containers. If the manufacturer maintains a container inventory that is too low to meet the needs of the suppliers (and therefore meet its production schedule), costs may increase because production is delayed as the manufacturer waits for parts. If production delays result from an improper allocation of containers, the manufacturer may choose to order more containers (often at a higher cost because the order must be expedited) in order to get the parts in a timely manner. If the manufacturer maintains a container inventory that is too high, it simply wastes money by storing and maintaining more containers than are really needed. Therefore, there is a need for a returnable container management system and method that supports the allocation and tracking of containers according to a manufacturer's production needs.

SUMMARY OF THE INVENTION

[0009] The present invention is a system and method for allocating and managing returnable containers according to actual part requirements determined by a manufacturer's production schedule. It aids the manufacturer's associates and its suppliers in accurately allocating and tracking returnable containers. It maintains the correct allocation of containers to suppliers during demand changes so that parts are received as needed for the manufacturing process. Because the allocation of containers is determined according to the manufacturer's production schedule, it

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reduces the need to maintain an inventory of returnable containers, and therefore, reduces production costs.

[0010] The present invention is a returnable container management (RCM) system and method that provides a dynamic web-based environment to allow all entities within a manufacturer's parts supply chain to view and manage returnable container inventories. The environment provides a manufacturer's associates and suppliers with maintenance capabilities to move and adjust container inventory throughout the entire parts supply chain. It also provides each supplier with access to view inventory that is in-transit to its facility as well as what is believed to be at its facility. The submission of on-line "shipment discrepancies" and "adjustment requests" are used by the supplier to manage any deviations between the actual and planned inventory quantities.

[0011] Returnable container movement is controlled through the use of "process flows" and their relationship with physical locations called "inventory holding areas." An inventory holding areas reflects the quantity of returnable containers that are held within that portion of the supply chain. Each of these portions is represented by an "inventory holding area type." Business rules are created and programmed into the RCM system and method based on the function of the inventory holding area types and the relationships between each other. These relationships are used to maintain consistent process flow creation and understanding between a manufacturer's facilities and supplier companies. A number of containers adequate to maintain the demand for parts according to the manufacturer's production schedule are allocated to each supplier. Movements of the containers are tracked to ensure each supplier has at all times a

physical inventory of containers that is adequate to ship parts in a timely manner to the manufacturer's facilities.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]   Fig. 1 is a returnable container flow analysis diagram for an example embodiment of the present invention;

[0013]   Fig. 2 is a process flow diagram for RCM inventory identification for an example embodiment of the present invention;

[0014]   Fig. 3 is a returnable container flow analysis illustrating inventory holding areas for an example embodiment of the present invention;

[0015]   Fig. 4 is a block diagram illustrating the allocation of containers to suppliers for an example embodiment of the present invention;

[0016]   Fig. 5 is a block diagram of key system components for an example embodiment of the present invention;

[0017]   Fig. 6 is a create inventory holding area screen for an example embodiment of the present invention;

[0018]   Figs. 7A and 7B areFig. 7 is a create process flow screen for an example embodiment of the present invention;

[0019]   Figs. 8A and 8B areFig. 8 is a maintain supplier profile screen for an example embodiment of the present invention;

[0020]   Figs. 9A-9C areFig. 9 is a maintain inventory holding areas screen for an example embodiment of the present invention;

[0021] Figs. 10A and 10B are~~Fig. 10 is~~ a sample bill of lading (BOL) for an example embodiment of the present invention;

[0022] Figs. 11A and 11B are~~Fig. 11 is~~ a receipt verification screen for an example embodiment of the present invention;

[0023] Figs. ~~12 and 13~~ 12A, 12B, 13A, and 13B are report discrepancies screens for an example embodiment of the present invention;

[0024] Figs. ~~14 and 15~~ 14A, 14B, 15A, and 15B are request adjustment screens for an example embodiment of the present invention;

[0025] Figs. 16A and 16B are~~Fig. 16 is~~ a pending adjustments screen for an example embodiment of the present invention;

[0026] Figs. 17A and 17B are~~Fig. 17 is~~ a supplier's on-hand inventory screen for an example embodiment of the present invention;

[0027] Figs. 18A-18C are~~Fig. 18 is~~ a shipping versus allocation report screen for an example embodiment of the present invention;

[0028] Figs. 19A and 19B are~~Fig. 19 is~~ an allocation management report screen for an example embodiment of the present invention; and

[0029] Figs. 20A and 20B are~~Fig. 20 is~~ a shipping history screen for an example embodiment of the present invention.

DESCRIPTION OF EXAMPLE EMBODIMENTS

[0030] The present invention is a returnable container management system and method that comprises a flexible and configurable tool to manage the returnable container process flow at a manufacturing facility regardless of the facility process and

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physical configuration as well as a tool to manage the container across all of a manufacturer's facilities. It provides a standard calculation for the supplier container allocation according to inventory movement, daily or weekly production forecasts, and safety stock information allowing for partial days, which yields an allocation based on actual part requirements according to the manufacturer's production schedule. It further provides a standard calculation for the container inventory at any identified stage of the container process flow according to inventory movement and safety stock information. It allows suppliers to verify their on-hand inventory and request adjustments online and understand their allocation quantity calculation. It provides the ability to record daily container process flow events of inbound and outbound shipments, shipment discrepancies, and inventory adjustments. Finally, it provides reporting, modeling, and forecasting capabilities to effectively manage the container process flow and container inventory and allocation eliminating guesswork.

[0031] Process flow information is used to determine how and where containers are used by the manufacturer in managing its supply chain. In addition, it allows the manufacturer to understand how quickly parts (and therefore, containers) reach a destination in the supply chain. The availability of containers for supplier shipments is affected by the amount of time it takes to fill containers at the supplier's facility, transport the parts to the manufacturer's facility, consume the parts at the manufacturer's facility, and transport the empty containers from the manufacturer's facility to the supplier's facility. For example, containers that are transported directly to the manufacturer's facility may be returned to the supplier's facility more quickly than containers that are transported to a supply consolidation center before being transported to the

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manufacturing facility. In addition, the container needs of suppliers that ship to a supply consolidation center in addition to shipping directly to the manufacturer's facility directly may differ from the container needs of suppliers that ship only to the manufacturer's facility. Because the availability of containers is affected by their "flow" in the manufacturer's parts supply chain, the process flow of containers is analyzed to determine the appropriate allocation of containers to suppliers.

[0032]   Referring to Fig. 1, a returnable container flow analysis diagram for an example embodiment of the present invention is shown. The container and information flows 112 of Fig. 1 identify the movement of containers through the manufacturer's parts supply chain. The manufacturer's suppliers 102 provide full containers of parts that are delivered directly to the manufacturer's facility 106 or to a supply consolidation center 104 where they are staged for delivery to one or more of the manufacturer's facilities 106. The containers are emptied at the manufacturer's facility 106 and then transported to a returnable container center (RCC) 108. In some instances, the empty containers (e.g., "supplier specific" containers or "special" containers) may by-pass the RCC 108 and be returned directly to the supplier 102. Supplier specific containers may be used for instances in which the supplier requires a unique container to ship its parts. Such containers are not pooled for distribution to any supplier because they can be used by only one supplier.

[0033]   Information regarding the full containers shipped by the suppliers 102 is entered into a computerized returnable container management (RCM) system 110. Additional information is entered into the RCM system 110 when the parts are received by the manufacturer (at the supply consolidation center 104 or the manufacturing facility

106). Information regarding the empty containers is entered when the containers are received by the RCC 108 and when they are shipped to the suppliers 102 from either the manufacturer facility 106 or the RCC 108.

[0034]   Because the present invention is Internet based, suppliers have access to information regarding the quantities of containers that have been allocated to them. Suppliers further use the system to view information regarding verification of shipments. Detailed shipment documents provide means for identifying, troubleshooting, and resolving container shipment discrepancies. Inventory movements and supplier access to container shipments provide means for communicating inaccuracies at the time they occur. Inventory movements are visible, with date and time stamps, and include container shipments to and from suppliers, container movements between the manufacturer's facilities, detailed quantities in-transit (full and empty) to and from suppliers. The manufacturer's associates can obtain detailed information about problems and resolve them quickly. The RCM system further supports identification of pooled and supplier specific containers/racks to facilitate their return to suppliers.

[0035]   The following tables show details of the flow analysis of Fig. 1.

Table 1

	Responsibility	Planned Activity	Impact of Deviation
Manufacturer's Facility	Shipments (empty)	Identify actual quantities shipped (accuracy)	Inaccurate inventory levels within system (potential surplus or shortage at supplier)
		Ship during scheduled window times (timely)	Suppliers inventory low/short due to in-transit delays
	Receipts (full)	Receive actual quantities shipped (accuracy)	Inaccurate inventory levels within system (potential surplus or shortage at supplier)
		Unload trailers to fulfill production needs (timely)	Appropriate trailers are not available to ship containers
	EDI Accuracy	Ensure part supply order	Electronic data is not available for

		information is accurate to the order	receipts
	Parameter Control	Maintain parameters to meet supply chain needs	Inventory unbalanced throughout chain causing shortage/surplus
	Produce product	Meet Scheduled Production	Deviations from planned receipt/shipment activity, supply chain unbalanced
	Maintain production plans	Maintain agreed to production levels/mix	Inventory unbalanced throughout chain causing shortage/surplus

Table 2

	Responsibility	Planned Activity	Impact of Deviation
Consolidation Center	Receipts	Receive actual quantities shipped (accuracy)	Inaccurate inventory levels within system (potential surplus or shortage at supplier)
		Unload trailers to fulfill production needs (timely)	Appropriate trailers are not available to ship containers
	Abnormal Shipping Notification	Notify appropriate parties of packaging shortage	No one prepared to repack or expedite needed quantities

Table 3

	Responsibility	Planned Activity	Impact of Deviation
Supplier	EDI Accuracy	Ensure order information is accurate to the order	Electronic data is not available for receipts
	Shipments	Identify actual quantities shipped (accuracy)	Inaccurate inventory levels within system (potential surplus or shortage at supplier)
		Ship during scheduled window times (timely)	Down stream delays to other suppliers, receipts, etc
	Receipts	Verify actual quantities shipped (accuracy)	Inaccurate inventory levels w/in system (potential surplus or shortage at supplier)
		Unload trailers to meet planned window times (timely)	Trailers delayed going to other locations
	Abnormal Shipping Notification	Notify appropriate parties of packaging shortage	No one prepared to repack or expedite needed quantities

Table 4

	Responsibility	Planned Activity	Impact of Deviation
Returnable Container Center	Shipments	Identify actual quantities shipped (accuracy)	Inaccurate inventory levels within system (potential surplus or shortage at supplier)
		Ship during scheduled window times (timely)	Suppliers inventory low/short due to in-transit delays

Table 5

	Responsibility	Planned Activity	Impact of Deviation
Logistics	Determine Allocation	Purchase container quantities to support planned allocation levels based on facility, supplier requirements	Inaccurate inventory levels within system (potential surplus or shortage at supplier
	Monitor/maintain Supplier Inventory	Conduct cycle count activities and adjust system to reflect actual situation	Inaccurate inventory levels within system (potential surplus or shortage at supplier)
	Abnormal Shipping Notification	Notify appropriate parties of packaging shortage	No one prepared to repack or expedite needed quantities

[0036]   Referring to Fig. 2, a process flow diagram for RCM inventory

identification for an example embodiment of the present invention is shown. Fig. 2

further illustrates the flow of container inventory from one physical location (called an

"inventory holding area") to another. The inventory holding areas provide details

regarding process flows and container types that are actually moving through the

system. "Requirements" as shown in Fig. 2 facilitate the identification of inventory

throughout the physical locations or inventory holding areas so that an accurate

accounting of containers may be determined. First, the designated supplier on-hand

quantity 120 is verified by the supplier 130. The supplier on-hand quantity 120 includes

empties ready for production, full containers waiting for shipment, and partials that may

be used for small lot packing. Next, the in-transit full quantity 122 representing

containers shipped from the supplier to the designated manufacturer is determined based on electronic data interchange (EDI) part supply order information sent by the supplier 132. The transfer of container inventory from the supplier in-transit full 122 to the designated manufacturer on-hand 124 is determined next. The manufacturer on-hand quantity 124 includes full containers waiting for assembly line side delivery, empties being processed at the RCC, and partials waiting assembly line side or in repack areas. Additional in-bound shipments or receipts (initial receipt function 136) as well as out-bound shipments (load destination RCC/supplier 140) are also considered in determining a designated manufacturer on-hand quantity 124. An in-transit empty quantity based on a container shipment from the designated manufacturer directly to the supplier reduces the on-hand inventory 146. Shipment receipts into the RCM system may be based on a transfer of inventory 144 from the designated manufacturer on-hand 124 to the RCC 126 to trigger a reduction of designated manufacturer on-hand inventory. Finally, in-transit empty quantity 128 to the supplier on-hand quantity 120 is determined 148 as well as receipt into the supplier's on-hand inventory 120 (transfer inventory from RCC/designated manufacturer on-hand to supplier 150) and receipt into a special area (transfer inventory from RCC on-hand to designated manufacturer on-hand 152). The in-transit empty quantity 128 is based on empty containers that have shipped and are still in route to a supplier and containers in route to a supplier with return parts.

[0037]   Referring to Fig. 3, a returnable container flow analysis illustrating inventory holding areas for an example embodiment of the present invention is shown. Returnable container movement according to the present invention is controlled through

the use of "process flows" 180 and their relationship with the "inventory holding areas" (physical locations) 160, 162, 164, 166. Inventory holding areas hold containers and reflect the quantity of returnable containers that are held within that portion of the supply chain. Each of these portions is represented by an "inventory holding area type" 170, 172, 174, 176, 178. According to an example embodiment of the present invention, inventory holding areas (container physical locations) in which containers may be stored before being moved to another location include a supplier's facility (supplier A) 160, a manufacturer's parts staging center (warehouse) 162, a manufacturer's production facility (plant A) 164, and a returns location 166. Associated with each inventory holding area is an inventory holding area type. Inventory holding area types associated with a supplier 160 include "supplier on hand" (SOH) 170, which represents containers physically at a supplier location, including any in-transit to the manufacturer, and "supplier in-transit empty" (SIE) 172, which represents containers that are being transported from the manufacturer to the supplier. Both inventory holding area types for suppliers are considered part of a supplier's allocation. Inventory holding area types associated with a manufacturer's parts staging center (warehouse) 162 include "consolidation center" (CC) 172. Inventory holding area types associated with a manufacturer's production facility 164 include "plant" 174. Inventory holding area types associated with a container returns location 166 include "returnable container center" (RCC) 176.

[0038]   Referring to Fig. 4, a block diagram illustrating the allocation of containers to suppliers is shown. Allocation of containers is based on actual part requirements. The manufacturer uses its production schedule to determine its need for parts over a

given time period (e.g., for a week). Part supply orders are transmitted to suppliers based on the manufacturer's production schedule so that the manufacturer receives the parts that are required the meet its production needs. Allocation of containers to suppliers is based on order system data 198 regarding the parts that have been ordered from each supplier according to the manufacturer's production schedule.

[0039]   Historical data regarding the time required by the supplier to produce and transport the parts to the manufacturer and for the manufacturer to consume the parts 192 are analyzed to determine a total day supply 196 for use in determining container allocations. For example, if it takes four days to transport containers between the supplier's facility and the manufacturer's facility (two days parts in transit and two days on-hand at manufacturer), three days for the supplier to produce the parts and load the containers (three days on-hand at supplier's facility), and two days for the manufacturer to consume the parts and prepare the containers to be returned to the supplier (two days on-hand at manufacturer's facility), then the total day supply is nine days 196. A "supplier parameter" or "standard allocated days" 194 of seven days represents the number of days that the container is in the supplier's inventory (whether in-transit or at the supplier's location). The number of containers to be released to the supplier (calculated allocation quantity) is then based on the parts requirements from the supplier orders and the supplier parameter (number of days the containers are on the supplier's side of allotment). The actual number of containers released is based on the calculated allocation quantity less the supplier on-hand quantity on the supplier's side. Using data from the order system 198, the RCM system 200 calculates a "standard

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allocated days" value for each supplier that is used to determine the calculated allocation quantity for each supplier.

[0040]   Referring to Fig. 5, a block diagram of key system components for an example embodiment of the present invention is shown. RCM data 210 comprises part demand and part supply order data as well as part, supplier, and packaging information and transportation information. This data is used to determine the types of containers required by the suppliers and each supplier's allocation of containers (calculated allocation quantity). The RCM system 212 determines container allocations according to the following formula:

[0041]   (supplier's "standard allocated days" x part demand) – on-hand containers at
        supplier

[0042]   The result represents the container quantity to be returned to the supplier. A return returnable container forecast by the manufacturer facility is based on the percentage of inbound containers at each facility. The parameters or values maintained by the RCM system 212 include the standard day's allocation by plant and the supplier/container type and quantity. If the containers are "supplier specific" or "special" such that the same containers are always shipped to the supplier, the shipping responsibility is provided. A critical inventory level (representing the percentage of total allocation) is maintained. Finally, return transit information for anticipated arrival of containers is maintained.

[0043]   Web access 214 is provided to users of the system including the manufacturer's associates and suppliers. The manufacturer's associates may access information related to:

[0044]   On-hand inventory at all of the manufacturer's facilities;

[0045]   Distribution quantity by supplier and container;

[0046]   Live "shipped" status for returnable containers due;

[0047]   Supplier "standard allocated days"; and

[0048]   Part and container information.

[0049]   In addition the manufacturer's associates may create records of outbound

shipments.

[0050]   Suppliers may access information related to their own on-hand inventory and

in-transit inventory, their required quantity, and their standard allocated days. In

addition, suppliers may communicate to the manufacturer on-hand discrepancies and

log returned returnable container shipments.

[0051]   Container inventory is visible at each of the manufacturer's facilities and at

supplier locations through detailed reports and maintenance sessions. The actual

quantity of containers at various physical locations (called "inventory holding areas")

received is easily visible on selected reports. The following reports may be generated

using the RCM system of the present invention.

Table 6

Activity Report 216	Measure volume of returns managed by location Trend analysis by location
Exception Report 218	Distribution not met Critical inventory level Negative distribution quantity No requirements by supplier Open inbound inventory status (past anticipated arrival)
Maintenance Activity 220	Report changes to "key" fields - on-hand quantities - allocation days - tracking system parameters
Custom Report	Report defined for specific department or plant use

[0052]   Referring to Fig. 6, a create inventory holding area screen for an example

embodiment of the present invention is shown. To create an inventory holding area

(inventory bucket), a user enters a name for the inventory holding area (inventory

bucket) and selects a type of holding area (inventory bucket type) 230. The types may

include RCC (returnable container center), CC (consolidation center), SOH (supplier on-

hand), SIE (supplier in-transit), etc. For type SOH or SIE, the user may select the

appropriate supplier from a list. The address for the selected supplier is entered

automatically 232.

[0053]   Referring to Fig. 7A7, a create process flow screen for an example

embodiment of the present invention is shown. The user selects a process flow type

from a list of types 240. The selected process flow type is based on the inventory

holding areas that should be included in the process flow. For example, a process flow

type of SOH-CC-PLT-RCC indicates that containers flow from the supplier's on-hand

(SOH) inventory holding area to a parts consolidation center (CC) inventory holding

area to the manufacturer's plant (PLT) inventory holding area to a returnable container

center (RCC) inventory holding area and finally to the supplier's in-transit (SIE)

inventory holding area.

[0054]   Next, the user is prompted to provide a name for the process flow and to

information regarding the inventory holding areas to include in the flow 242. The user

may also provide a description of the process flow. Relationships within the flow are

displayed to user 244 and indicate where the containers are transported at each step in

the flow. For example, for the relationship SOH-CC, containers are moved the SOH

inventory holding area that the user identified previously "supplier1" to the CC inventory holding area that the user identified previously "TP1." Finally, the user may select the container types that are tracked with the process flow 246 as shown in Fig. 7B.

[0055] Referring to Fig. 78A, a maintain supplier profile screen for an example embodiment of the present invention is shown. This screen allows an administrator of the RCM system to enter search criteria based on a supplier name or number 250. The screen displays the search results 252. The user may select a supplier from the search results 252 and update the supplier contact information 254 and contracted container types 256 as shown in Fig. 8B.

[0056] Referring to Fig. 9A8, a maintain inventory holding areas screen for an example embodiment of the present invention is shown. The user may select options for searching inventory holding areas including the specification of an inventory holding area name and inventory holding area type 260. The "process flow" shown in this section relates to the flow of containers from one inventory holding area to another based on the selected holding area name and type. The process flow information indicates where parts from the supplier flow in the supply chain (e.g., to a parts consolidation center, directly to the manufacturer's facility, etc.) and may be used to calculate an allocation quantity for the supplier.

[0057] Referring to Fig. 9B, recordsRecords that match the user's selection criteria are displayed on the screen 262242. The user may select one of the records and update the inventory holding area information associated with the selected record 264. Referring to Fig.9C, theThe screen further displays details regarding the container · process flow for the selected inventory holding area and type 266. For example, a

supplier-on-hand (SOH) inventory may flow from the SOH holding area to the manufacturer's parts consolidation center (CC) to the manufacturer's plant (PLT) and finally, to the manufacturer's RCC.

[0058]   Referring to Fig. 10A9, a sample bill of lading (BOL) for an example embodiment of the present invention is shown. The BOL may be generated in response to a container ship request that is completed by a manufacturer associate. The BOL identifies the supplier to which the containers will be shipped 270 as well as details regarding the number of containers, type of containers, and description of containers 272. Referring to Fig. 10B, theThe shipping order further specifies detailed information regarding the party shipping the containers 274.

[0059]   Referring to Fig. 11A and 11B10, a receipt verification screen for an example embodiment of the present invention is shown. Referring to Fig. 11A, theThe user may view and modify received shipments that need to be verified. The screen provides a list of records from which a user may select 280. The user may then view details regarding a selected shipment 282. The details indicate the receipt status, associated bill of lading number, departure date and time, truck and trailer information, ship from and ship to locations, and receipt information. Referring to Fig. 11B, theThe user may select the "receive shipment" option 284 to indicate that the quantity shipped actually matches the BOL quantity. The shipment is then removed from the list. If there are differences between the BOL and the actual quantity received, a receiving discrepancy may be filed by the supplier.

[0060]   Referring to Figs. 12A, 12B, 13A, and 13B, 11 and 12, report discrepancies screens for an example embodiment of the present invention are shown. The user may

view past shipments 290 as shown in Fig. 12A11. Upon selection of a record, the user may view details regarding the selected shipment 292 and select the "report shipping discrepancy" option 294 to proceed to the screensscreen of Figs. 13A and 13BFig. 12.

[0061]   Referring to Fig. 13A13, the user may view details regarding the shipment 300 and enter information regarding the discrepancy 302. For each container type, the user may then enter the actual quantity received next to the container type 304. If an unknown container type arrives at the supplier's facility, information regarding the unknown container type may be entered and reported to the manufacturer 306 as shown in Fig. 13B.

[0062]   Referring to Figs. 14A, 14B, 15A, and 15B14 and 15, request adjustment screens for an example embodiment of the present invention are shown. Referring to Fig. 14A14, when the request adjustment option is selected 310, past discrepancy reports are automatically displayed 312. For each selected record, as shown in Fig. 14B, details are shown that include the request date and time, supplier name, request type, status, and shipment data (BOL number, departure date and time, ship from and to locations) 314. Finally, the details of the discrepancy (e.g., shipped quantity and received quantity) are shown 316.

[0063]   Referring to Fig. 15A15, the user may enter details regarding the requested adjustment 320. The user may specify a supplier identifier 320 and data regarding the container types and system on-hand inventory as well as functional on-hand inventory (containers that may be used for production) and damaged on-hand inventory (containers that cannot be used for production) 322.

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[0064] Referring to Figs. 16A and 16BFig. 16, a pending adjustments screen for an example embodiment of the present invention is shown. A list of pending adjustments is displayed 330 as shown in Fig. 16A. The user may select a record and view details regarding the selected record 332 as shown in Fig. 16B.

[0065] Referring to Figs. 17A and 17BFig. 17, a supplier's on-hand inventory screen for an example embodiment of the present invention is shown. Referring to Fig. 17A, theThe user may specify selection criteria (e.g., container type and inventory holding area type) 340 and view details regarding the quantity of containers that meet the selection criteria 342. Referring to Fig. 17B, eachEach container type may have a total of four quantities listed: supplier on-hand (SOH), supplier in-transit empty (SIE), supplier in-transit full (SIF), and the total of the SOH, SIE, and SIF. The SIF quantity indicates the number of containers in-transit to the manufacturer and is considered part of the SOH quantity until shipment receipts are verified by the manufacturer. Once the shipment receipts are verified, the SIF quantity is deducted from the SOH quantity.

[0066] Referring to Figs. 18A-18CFig. 18, a shipping versus allocation report screen for an example embodiment of the present invention is shown. After specifying report criteria as shown in Fig. 18A, thisThis report shows the supplier's allocated quantity by container and manufacturer facility 350 as shown in Fig. 18B. It also shows what percentage of the allocation is filled with the supplier's current inventory levels. There are two types of allocation: "allocation requirement quantity" 354 and "allocation level" 352. "Allocation requirement quantity" 354 is based on a given number of containers that must be maintained for the supplier. "Allocation level" 352 is based on actual orders and shipping requirements that are sent from the manufacturer's purchasing

department to the supplier. When viewing the "allocation level" 352, a quantity needed for a range of dates is shown. This quantity may change based on fluctuations in demand.

[0067]   Selecting a record results in the display of details 356 as shown in Fig. 18C. Past shipments for the container type selected are displayed 358. Shipment dates and times are shown as well. The calculated quantity 360 is the system generated quantity needed to fulfill the allocations. The actual quantity 362 reflects the number of containers actually shipped. A discrepancy quantity 364 shows the overstock or under stock of containers in relation to the actual quantity. A "safety stock quantity" 366 may also be maintained for intermittent problems. In an example embodiment of the present invention, this report is updated frequently (e.g., every hour or two hours) to reflect parts shipments that are received by the manufacturer.

[0068]   Referring to Figs. 19A and 19BFig. 19, an allocation management report screen for an example embodiment of the present invention is shown. The allocation management report presents a historical record of changes to the supplier's allocation. The user may specify selection criteria including a date range and types of transactions 370 as shown in Fig. 19A. The screen then displays data related to the user's selection criteria 372 as shown in Fig. 19B.

[0069]   Referring to Figs. 20A and 20BFig. 20, a shipping history screen for an example embodiment of the present invention is shown. The shipping history report displays details of all shipments made by the manufacturer over a selected period of time. The user may specify selection criteria such as a supplier, container type, and date range 380 as shown in Fig. 20A. The shipping history report 382 of Fig. 20B

shows calculated quantities 384 and actual quantities 386 as well as a discrepancy 388 that reflects the difference between the calculated and actual quantities.

[0070] The present invention comprises a computerized RCM system for managing the flow of returnable containers in a manufacturer's parts supply chain. It determines an appropriate allocation of containers for each supplier in the supply chain and accounts for the flow of containers at various physical locations (inventory holding areas) to ensure that each supplier has an adequate supply of containers to maintain the manufacturer's production needs. The example screens of the present invention that have been presented help to explain the returnable container management concepts of the present invention. A RCM system according to the present invention may comprise many additional screens to facilitate computer interactions including administration screens that allow an administrator to manage user accounts, interactions with other systems (e.g., part supply order databases), etc.

[0071] While example embodiments of the invention have been illustrated and described, various modifications and combinations can be made without departing from the spirit and scope of the invention. For example, the number and the related categories and types of containers that are managed according to the present invention may be increased or decreased. In addition, the screens that are presented to users of the system and method may be modified or organized in many other ways to accomplish the same goals. Modifications, combinations, and equivalents to the system and method of the present invention are intended to be covered and claimed.

ABSTRACT

[0072] The present invention is a system and method for managing returnable containers according to a manufacturer's production schedule. It provides capabilities to move and adjust container inventory throughout the entire parts supply chain. Movements of the containers are tracked to ensure each supplier has at all times a physical inventory of containers that is adequate to ship parts in a timely manner to the manufacturer's facilities. Container movement is controlled through the use of process flows and their relationship with physical locations called "inventory holding areas." An inventory holding area reflects the quantity of containers that are held within that portion of the supply chain. Each of these portions is represented by an "inventory holding area type." The system and method operate based on the function of the inventory holding area types and the relationships between each other.